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In Lucy Cranwell's footsteps: vegetation history in the south

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Introduction

I was delighted to be asked to present the 1999 Lucy Cranwell Lecture, for many reasons, but especially because I regard myself as one of her direct scientific descendants. While Lucy Cranwell has had a pervasive influence on Auckland botany, and made a significant contribution to New Zealand botany as a whole, she is a towering figure in my speciality, pollen analysis. Not only did she undertake the first work in that field in New Zealand, but she provided it with the tools in the form of collections, books, journal publication and identification keys which have sustained it down to the present. In a black art such as pollen analysis, or indeed any palaeoecological analysis where so much depends on the accuracy of the initial identifications and the experience and probity of the practitioner, direct transference of skill and attitude is crucial. Lucy Cranwell ensured that she would have a human legacy in pollen analysis, through having introduced Bill Harris to the subject, who in turn passed on his knowledge to Neville Moar, who trained me. Thus, I can trace a direct line back to Lucy Cranwell in an unbroken succession, and hence my claim to be her scientific great–grandson.

In recent years I have begun to do intensive work in the southern South Island. As this is also the region where Lucy Cranwell undertook her pioneering work, I am in a good position to comment directly on how that work now looks in relation to what we know now. I will then discuss some new work we are pursuing on the subantarctic islands in order to answer some of the difficult climate questions that still remain unsolved despite 64 years of effort.

The work I will present is the result of a collaborative effort of a small team we have at Landcare Research Lincoln: myself, Janet Wilms–hurst, Alison Watkins, and our research associates Neville Moar, Peter Wardle and Brian Molloy.

Lucy Cranwell's contribution to palaeoecology

Lucy Cranwell played an important role in New Zealand botanical life both before and after World War II. After undertaking a great deal of botanical field work – of a type which members of this organisation will be familiar with – often in association with another Lucy – Lucy Moore – she began to specialise in marine algae (subject of a Lucy Cranwell Lecture by Wendy Nelson in 1993), pollen morphology (subject of a Lucy Cranwell Lecture by P.B. Tomlinson in 1997), pollen analysis, and peatlands, especially the Waikato Bogs. We shouldn't neglect to mention that during the period of her scientific activity in New Zealand she was a full time curator in Botany for the Auckland Institute and Museum which she joined in 1929. Besides the normal activities of this posting, she also took a great interest in public education (John Morton speaks of this in his 1994 Lucy Cranwell Lecture), wrote columns and gave radio talks. She ran a very successful Native Flower Circle for children, associated with her work at the Museum and her botanical articles for the *Auckland Star*. However a very good case can be put for her major and lasting achievement to be in the field of palaeoecology, especially in the discipline of pollen analysis.

Lucy Cranwell's interest came about as follows. In 1935 she and Lucy Moore visited Europe, first to Scandinavia, then to the *Empire Botanical Conference* in London and finally to the *VI International Botanical Congress* in Amsterdam. What happened next is best put in the words of a close observer, Lucy Moore, in her wonderful 1985 Lucy Cranwell Lecture:

"It was here [Amsterdam] that arrangements were made for LMC to return to Stockholm to work with Dr Lennart von Post whom she designated the world–famous head of the pollen "religion". He held the peat samples collected by the Swedish geologist C.C. Caldenius in Otago and Southland and was impatient to know what their pollen content could reveal about the early vegetation of New Zealand, as an indicator of climate history. From the collaboration resulted a joint paper "Post–Pleistocene Pollen Diagrams from the Southern Hemisphere I. New Zealand.", published in February 1936. ... To me it seems miraculous that so much was accompanied in five short months of the frigid Stockholm winter: to set off from scratch to get to know the pollen grains well enough to identify them in this difficult medium; and then, with von Post, to translate this information into a probable picture of the probable vegetation and so deduce the changes in climate; and as well to complete the writing of the paper! In a letter received just the other day Lucy said "Some people think we made some mistakes. At that time the Northern pollen people were still confusing violet pollen with that of oak, so I guess I should be allowed a few mistakes"... This sojourn in

Stockholm opened up a whole new field of study, not only for LMC, but for New Zealand botany in general.

Now, I have to admit, that I am probably "some people". I was fairly mean-spirited about Cranwell and von Post's work when I published some pollen diagrams from within the Southland region in 1983.

"Their [Cranwell & von Post, 1936] fundamental conclusion that there was a late glacial period of harsh climates followed by a milder, early Holocene episode, and that this early Holocene optimum was followed in turn by deteriorating climates and widespread vegetation change, is unchallenged. However, lack of detail in their pollen work meant that only the most striking changes were observed, and failure to distinguish *Dacrycarpus* from *Dacrydium cupressinum* resulted in the assumption that *Dacrydium cupressinum* was common in the early forests. This in turn led them to characterise the early Holocene as wet and mild, whereas we suggest that this period was somewhat drier than the present." (McGlone & Topping, 1983: p. 314).

This is a remarkably ungenerous summary of their pioneering work. Part of what I intend to do here is to make amends.

Cranwell & von Post and the postglacial history of the southern South Island

First of all, what did Lucy Cranwell achieve with that first publication? To answer that, I first have to briefly speak about what is pollen analysis. Pollen analysis, in essence, is a simple technique, totally analogous to recording vegetation plots in present day ecological work. Pollen grains are small (roughly 5 to 200 μm) and are therefore in the dust size category. Pollen grains are highly diverse, in size, structure and ornamentation of their outer walls. Many genera and a reasonable number of species in New Zealand can be identified from their pollen, although some groups are so uniform that they can only be identified at the family levels. Despite being small, they have tough outer walls that preserve well as long as there is insufficient oxygen to permit sustained bacterial and fungal biological activity. Thus both saturated or very dry sediments can preserve pollen well. Being small, many thousands of pollen grains are usually contained within a cubic centimetre of sediment. Pollen grains are extracted using a variety of chemical and physical means from a wide range of sediments including peat, lake muds, soils, deep sea floor muds, cave silts and ice. Lucy Cranwell used peat sediments, and that has remained as a tradition in New Zealand, whereas in most other countries, lake sediments are preferred. All of the work I talk about here is from peat sites.

After extraction, pollen are mounted, usually in glycerine jelly or silicone soil, on a slide, and examined under high power (normally x400) microscope. Usually something in the order of 250 to 1000 pollen grains are counted to ensure statistical accuracy. In most cases the abundance of pollen grains per cubic centimetre is calculated. If the accumulation rate is known accurately enough from radiocarbon or other dating techniques, the influx rate of pollen grains per cm^2 per year can be estimated. This 'influx' or 'absolute' technique in the 70s and 80s was thought to hold out a great deal of hope for accurate reconstruction of vegetation from pollen, but it now seems that in most cases calculating pollen as a percentage of a selected pollen sum gives more information. It is these percentage diagrams I will talk about.

Lucy Cranwell and Lennart von Post pollen analysed six sites from Southland/Otago, at 25 cm intervals, for a total of 81 samples in which they counted about 200 to 300 grains per sample. We judge it good going if we can complete 4 pollen slides a day, doing little else. So completing this volume of work was exceptionally good going, especially when it is realised that most of the pollen grains were unknown to them when they began their work. Not only that, they had to deduce what the various pollen percentages meant in the absence of any survey of the modern pollen rain.

As a consequence of this initial work, Lucy Cranwell realised that detailed, illustrated pollen floras and keys had to be produced before much progress could be made. After her return to New Zealand from Sweden, she built up a collection of pollen slides – a collection that was inherited by Botany Division DSIR, and is still retained by Landcare Research. From this material she first described in two separate publications the southern beeches and conifer grains (Cranwell 1939 and 1940) and then a detailed key to the whole pollen flora (Cranwell 1942). After she left for the United States she completed a detailed illustrated flora to the monocotyledons (*New Zealand Pollen Studies: The Monocotyledons*. 1953), but had to abandon plans to extend this atlas to the whole New Zealand flora as she intended. Bill Harris followed up with *A Manual of the Spores of New Zealand Pteridophyta* (1955), Mark Large and John Braggins with *Spore Atlas of New Zealand Ferns and Fern Allies* (1991), and in 1993 Neville Moar completed the series with *Pollen Grains of New Zealand Dicotyledonous Plants*. Lucy Cranwell therefore gave New Zealand pollen analysis the best possible start, provided it with the reference material in form of descriptions and slides to enable it to proceed with confidence, and began a tradition of excellent pollen floras.

However, back to the impact of the early Cranwell and von Post work. Here's an updated version for one of the sites that Lucy Cranwell published a couple of years later (Fig. 1) (Cranwell 1938: Fig. 9). For comparison, I present a more recent diagram from my own work from the Longwood Range in the same general area (McGlone and Bathgate 1983) (Fig. 2).

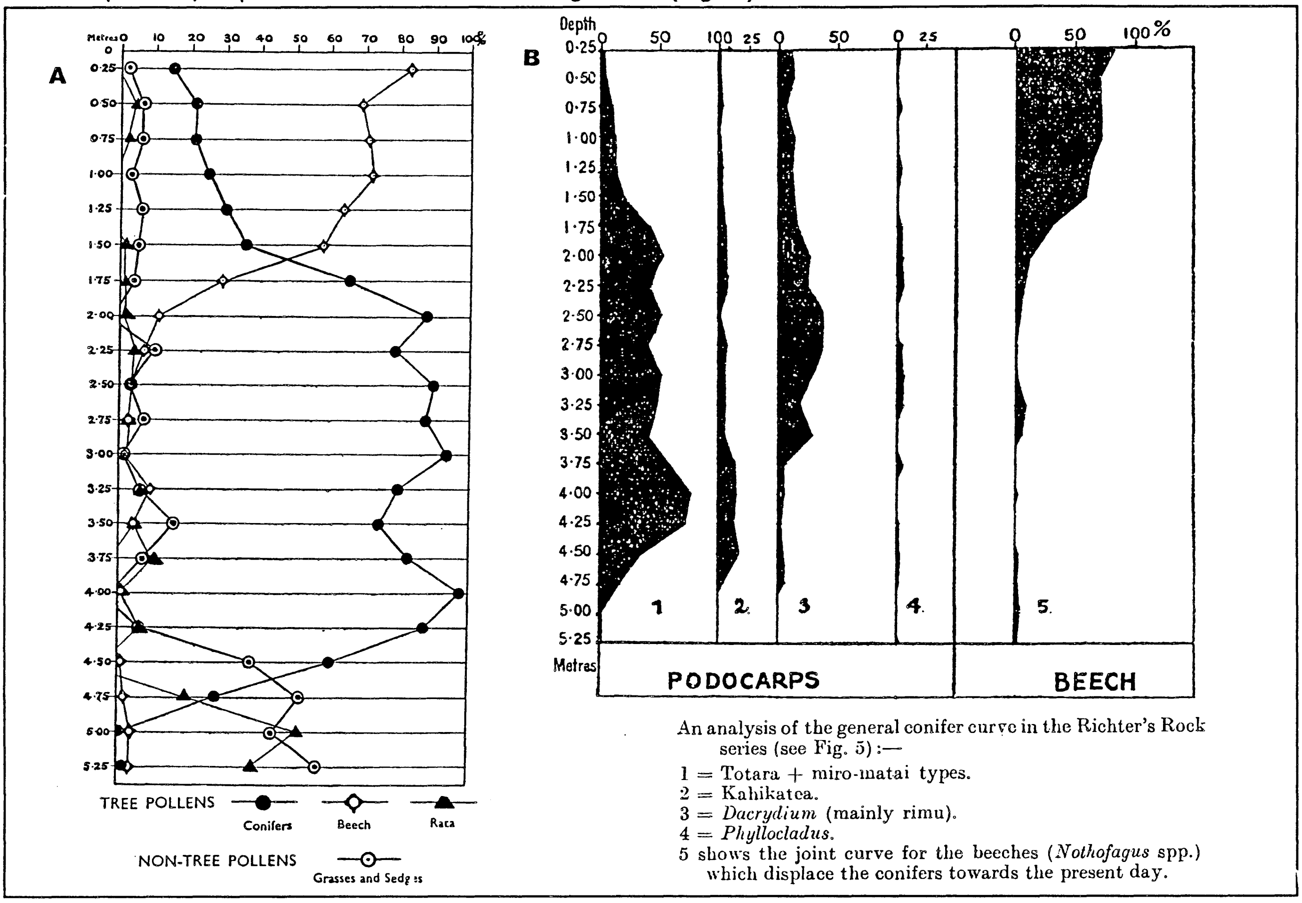

Fig. 1. Richter's Rock (L. Manapouri, Fiordland). **A** Summary pollen diagram for all types; **B** conifer and beeches. From Cranwell (1938). Note the early blip of beech (silver beech) at around the 3.25 m level; sub-sequent work has demonstrated that this is a widespread feature of southern South Island pollen diagrams, and may indicate a temporary climatic deterioration.

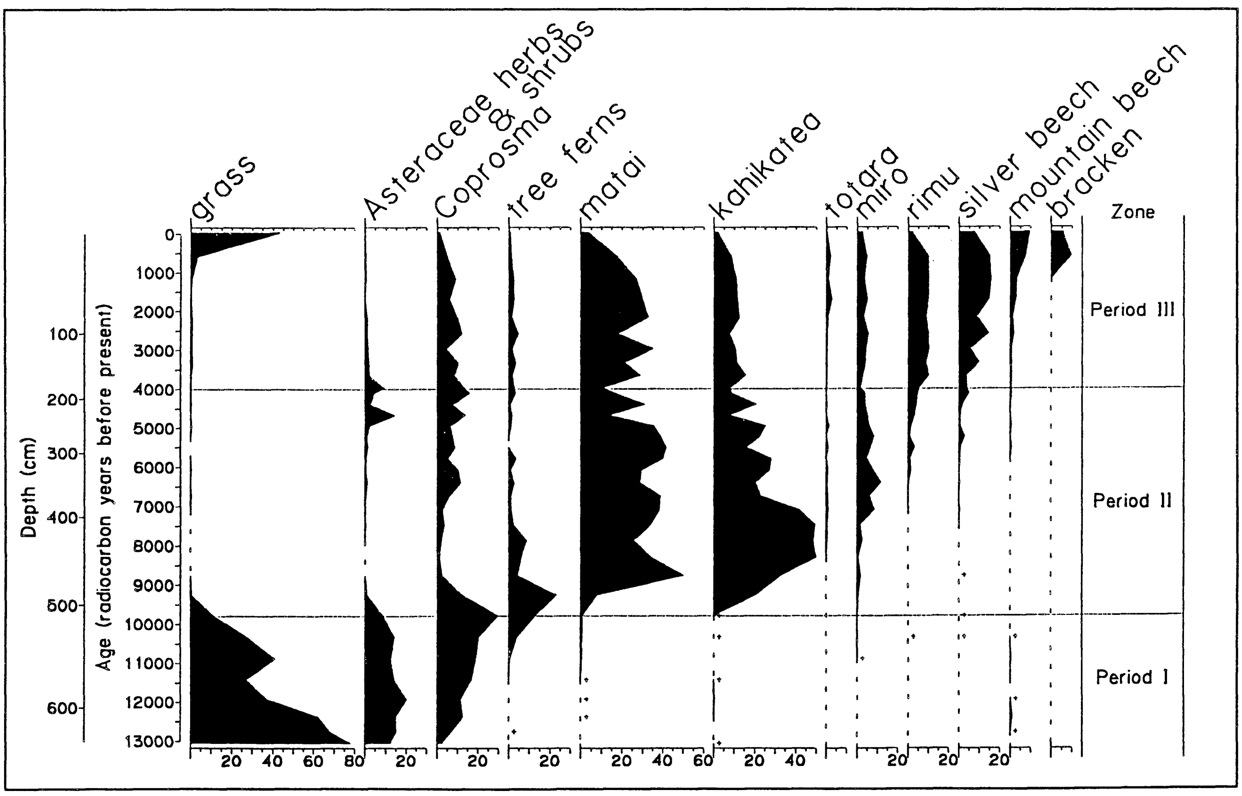

Fig. 2. Pollen diagram, Merivale, near Longwood Ra, western Southland. Period 1, II and III after Cranwell & von Post (1936).

Cranwell and von Post divided the period from the beginning of peat growth into three phases:

I. Grassland period;
II Podocarp forest period;
III. *Nothofagus* forest–grassland mosaic period.

They interpreted them in climate terms as follows:
Period I. Final stage of the last period of glaciation. Severe climate with slight regional differences only.
Period II. Uniformly wet and, probably, warm climate.
Period III. Deterioration of the climate. Distinct differentiation into local climatic districts.

For a whole generation of ecologists, this became the gospel truth. Once Jack Holloway had produced his magnum opus in 1954, which discussed in detail the impact of the Little Ice Age and Little Climatic Optimum on the forests of New Zealand, there was a range of interpretative tools in place to explain virtually any ecological situation or distribution. How has this Cranwell-van Post interpretation of post-glacial vegetation and climate change stood up to recent investigations?

Vegetation and climate history of the southern South Island

Most of our information about the full–glacial in Southland–Otago area comes from pollen and spores in the occasional peaty layer in loess or gravels which indicate open grassland or tundra conditions. This conclusion is supported by geomorphic and deep sea core evidence for harsh climates characterised by cool annual temperatures, wind and frost. We can now date Period 1 as beginning around about 14,000 years ago (I will use radiocarbon years throughout). It represents a transitional period between the harsh climates of the full–glacial period (25,000 to 15,000 years ago) to the present interglacial which began around about 10,000 years ago. I tend to follow overseas usage and call this period the "late–glacial". We have now identified many more pollen taxa from this period, but by and large, the Cranwellian description of it as "glacial conditions with steppe climate" still holds. Some small areas of hardwood forest grew close to the ice margin in Fiordland 18,000 years ago, and the distribution of beech forest across Southland and Otago suggests that a subalpine type forest may have persisted in scattered patches across the interior. But the general vegetation was open, discontinuous grassland and low shrubland, much of which would have been made up of low growing shrubs of *Coprosma*, *Myrsine*, *Muehlenbeckia*, and Asteraceae.

Period II, the podocarp forest period of Cranwell and von Post, was marked by the rapid rise of tall conifer trees throughout Southland–Otago and across the lower two–thirds of the South Island. In most lowland sites we can now say with some confidence that the dominant species were matai and kahikatea. Repeated dating of this event at a number of sites has shown that it occurred between 10,000 and 9500 years ago. Cranwell and von Post regarded podocarp forest as the expression of "a very wet, almost always warm, and equable climate.", thus leading to their conclusion that the climate was "Uniformly wet and, probably, warm...".

There are several point to note here. First, the abundance of podocarp forest across Southland and coast Otago, and the absence of beech or grassland in any of the districts where they are now common, led them to propose that the climate was more uniform and less regionalised than it is now. The greater number of sites we have now enables us to say that, if anything, the climate was somewhat more regionalised at that time. Coastal Southland–Otago was indeed largely in tall matai–kahikatea podocarp forest, but central Otago was in scrub and grassland until about 7500 years ago, indicating very dry conditions. Western Southland appears to have been much wetter than other sites at that time, with rimu and miro predominant after an initial phase of kahikatea and matai. The Longwood Range, the Catlins and Stewart Island had a initial phase during which tree ferns were common or even dominant, and a tree fern–hardwood forest persisted on Stewart Island. It is difficult to come up with a climate scenario that encompasses this range of variation. On the basis of the absence of forest in central Otago and the predominance of matai and kahikatea in the lowlands, the climate was probably drier than now. Forest modelling we have done for this period suggests that temperatures would have had to have been around 1°C higher than now, and rainfall between a third and one half less than now to have resulted in these sorts of forest. Despite this drier climate, we see no evidence that fire was common. In fact, drought seems to have been less common than now.

There are several factors that may have contributed to this rather unusual climatic regime. First, summers were less sunny. Because of changes in the earth's orbit around the sun, about 5% less solar energy was received in summer 9000 years ago, but more in winter. Second, the forest distribution suggests that in place of the present predominant westerly to southwesterly flow over the southern South Island, airflow was more from the northwest, and stable highs governed the climate pattern. Third, we believe that ENSO – the El Niño-La Niña climate pattern – was greatly weakened. All of this would have produced a drier more stable winter, and a somewhat drier but very much less variable summer.

There are two more factors which Cranwell and von Post did not consider. Soils were rejuvenated by the glaciation, and the initial podocarp forests would have been the first deep-rooted trees to have grown on these soils. An abundance of unweathered soil seems to favour matai and kahikatea, the first on dry soils, and the second on damp alluvial deposits. The second factor is migration. The wind-dispersed beeches are known to be less capable of rapid dispersal and establishment than the bird-dispersed podocarps, and there is a possibility that this played a role in their failure to take a more prominent role in the early post-glacial.

The initial podocarp forests began to alter during Cranwell and von Post's period II. Rimu and miro became more common after about 8000-7000 years ago, especially in wetter districts, and forest spread into central Otago. The best interpretation of this is that wetter and possibly cooler climatic conditions gradually established over this time.

By about 4000 years ago, silver beech was spreading vigorously in a large number of localities across Southland-Otago, from tree line to lower montane sites, and this provides a lower time horizon for Period III. It appears that this largely synchronous spread was – as Cranwell & von Post suggested – climate-driven, rather than a mechanical response to migration. At a number of sites (for instance the two figured here) we can see that silver beech was present during the earlier podocarp forest phase, and indeed increased markedly at times only to subsequently contract. The final rise to dominance of silver beech was therefore probably a consequence of cooler, wetter and, perhaps most importantly, more variable climates. In many western sites the period of silver beech dominance was short-lived, as red and mountain beech replaced it between 2000 and 1000 years ago. Mountain beech is considerably more hardy than silver beech: it can stand poorer soils, more exposed conditions, and lower temperature extremes. Even on Stewart Island, where beech is absent, there was a major change during period III. Here it was marked by an expansion of rimu and miro into previous rata and kamahi dominated forests.

Something not considered by Cranwell and von Post was the possibility that the Southland–Otago forest had been burnt by Maori. Fires lit by these first settlers destroyed most of the forest and tall scrub in the east, leading to a vast expansion of bracken and tussock grassland. We have dated this event at many sites to the 12th Century (beginning c. 800–750 years ago). Cranwell and von Post's conclusion that this period resulted in the current mosaic of podocarp, beech, scrub and grassland is correct, but the attribution to a deterioration of climate only partially true.

All in all, I have to say that the Cranwell & von Post scheme has held up remarkably well. The major conclusion that a steppe-like environment was replaced by a forest environment, growing under more benign climates than those of the present is confirmed. Also, their conclusion that this was followed by a period during which climates became progressively less favourable resulting in the expansion of beeches. Research since has shown that vegetation patterns are more complex than initially envisaged, but that they can be encompassed within a broad scheme of a cool, semi–arid climate giving way to a stable, warmer, and wetter but drier than present climate, in turn followed by the wetter, cooler, more variable and more drought-prone climates of the recent past.

Recent work on the subantarctic islands

In their 1936 paper Cranwell & von Post hinted that the subantarctic islands might provide analogues for Period I, but concluded that further progress was likely to be made through pollen analytical work in the Auckland Province which would offer "excellent parallels to those of the South Island, but, also, because of the greater contrasts between the main components of the vegetation, to register still more sharply all such changes of climate as may result in phytogeographical changes." I think my jaundiced southern eye detects more than a little northern chauvinism here. Recently a number of pollen analysts, including Rewi Newnham, Mike Elliott and Mark Horrocks, have taken up the challenge that Lucy Cranwell was unable to pursue. They have documented the major changes that have occurred over very long periods, and what was once the mysterious north has become much better known (Newnham 1999). However, I must admit that the promise held out by Lucy Cranwell as to more clarity in the vegetation changes seen have not eventuated. The pollen diagrams record unbroken podocarp dominance throughout the last 15,000 years, and changes registered have been relatively slight compared to the south. Moreover, many of the common hardwood elements in northern forests are under–represented in pollen diagrams: tawa pollen for instance is almost never encountered. As in the south, the burden of interpretation of pollen diagrams is largely borne by the wind-pollinated conifers, and this gives less insight into those highly diverse forests as a whole than into the conifer dominated forests of the south.

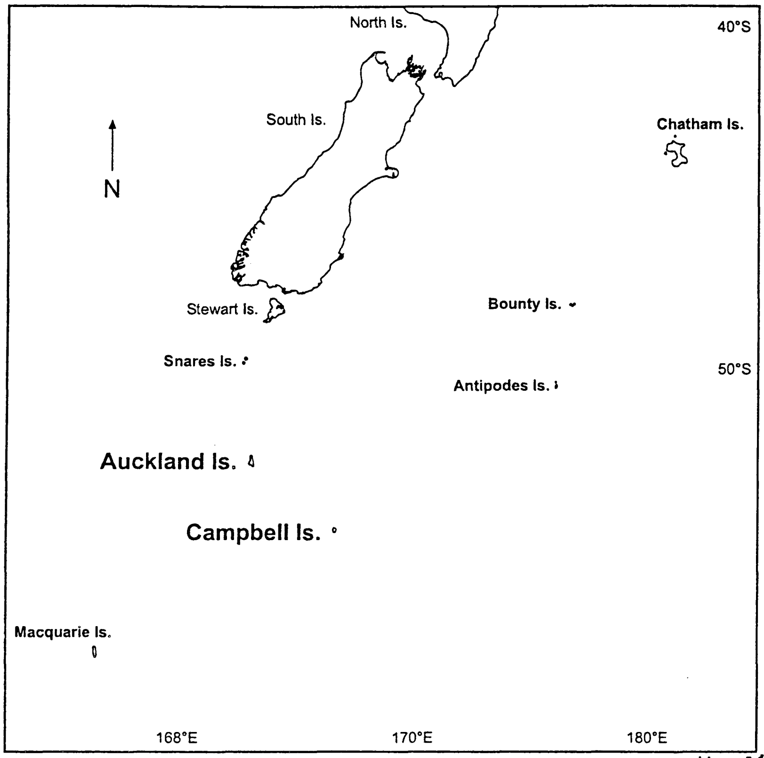

Fig. 3. Location map, subantarctic islands

We in the south have, naturally enough, turned instead ever further southwards in search of clarity. To Auckland. Not the province, but to Auckland Island and Campbell Island in the subantarctic (Fig. 3). One of the questions we are most interested in is the exact nature of the early Holocene period. Were climates actually warmer and more settled? And if so, was tree line higher during that period? What were those tree lines like in the absence of beeches, which currently form the highest tree lines in the country?

How can the subantarctic islands help us with these questions? Well first of all, they have very restricted floras. Auckland Island has a total indigenous vascular flora of only about 190 spp, and only 12 woody species. For those 12 species we have 8 pollen types, which gives a great advantage as all the important woody species can be identified from their pollen. A further advantage is that there is no group of tall, wind–pollinated species which the dominate the pollen rain. It is therefore possible to identify most structural vegetation types with a great deal of accuracy from the pollen rain. On the New Zealand mainland, often only a generalised picture is possible because many species share a single pollen type, and the pollen rain is dominated by a few wind-dispersed pollen types.

From the environmental point of view, the subantarctic islands could hardly be better for our sorts of investigations. Auckland Island, where we have done the most intensive work to date, is a good example. Auckland Island has a moist, cloudy, cool windy very oceanic climate, with a mean annual temperature of c. 8°C, and, more importantly, a mean temperature of 11°C during the summer months, which means it lies just one degree below the thermal limit for tree growth in temperate climates. As the Auckland Islands are close to the limit to woody growth, the vegetation structure is very responsive to subtle changes in exposure, soil moisture and temperature. It is therefore highly likely that even minor fluctuations in the climatic regime will be registered in the fossil record. Tall (>10 m) forest of rata (*Metrosideros umbellata*) on the Auckland Islands is limited to a narrow coastal band and extends no more than about 25 m above sea level, and then only on sheltered sites. Smaller rata trees form an increasingly stunted forest up to about 50 m altitude on well drained sheltered slopes. Rata trees and shrubs form a significant part of the lower altitude scrub together with *Myrsine divaricata*, *Raukaua* (*Pseudopanax*) *simplex*, *Dracophyllum longifolium* and *Coprosma* spp. With increasing altitude, *Myrsine* and *Coprosma* dominate the scrub, and the woody vegetation pollen rain above 200 m is mainly of these taxa. However, scattered stands and stunted individuals of rata, *Dracophyllum* and *Raukaua* are found up to the limit of scrub at about 300 m altitude.

And finally, the subantarctic islands are largely covered in peat: probably more than 95% of the land area. It is deep, ranging from 0.5 to 4 m under forest, to up to 7-10 m under bog. This means that you can go virtually anywhere on the island and extract some sort of a vegetation history.

We undertook an extensive vegetation and pollen survey of over 100 sites on both Campbell Island and Auckland Island in 1994 and in 1999 (McGlone & Moar 1997). The results from this work confirmed that there is a very good relationship between pollen rain and the various vegetation types. We already had the advantage of some early work done by Neville Moar, and planned our work around dating some of the major vegetation transitions he observed, and extending some of the observations to other sorts of sites.

Neville Moar (Moar 1958) had shown by pollen analysis from bog sites at the northern end of Auckland Island that the vegetation history fell into four phases. First, an early grass dominated phase; second, a scrub and bog vegetation dominated phase, a forest phase, and then a reversion to scrub and bog vegetation. We decided to drill and pollen analyse two sites across a forest–bog boundary at low altitude at a site not too far distant from Neville's. Our initial aim was to radiocarbon date these major changes in vegetation type, and to see how stable the forest/bog boundary, and the forest itself, had been.

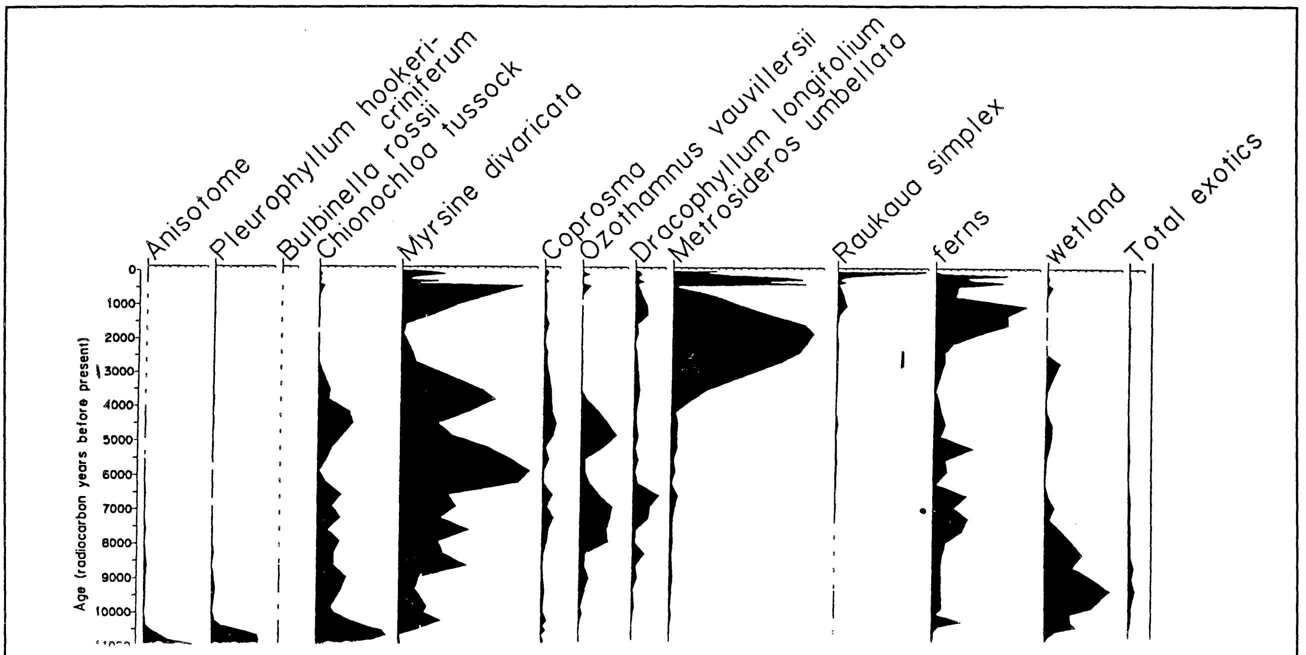

Fig. 4. Pollen diagram, forest site, Deas Head, Auckland Island.

The forest site was about 3.5 m deep (Fig. 4), and the bog site, about 6.5 m deep (Fig. 5), and they are about 100 m apart. Both began to accumulate about the same time, 12,000 years ago. The vegetation at the sites was dominated by megaherbs for the first 1000 years, but gave away to tussock grassland round about 11,500 years ago, and a mixed scrub–grassland–wetland of tussock, *Myrsine*, *Coprosma* and *Ozothamnus* and wetland plants formed at around 10,000 years ago. At around 8000 years ago, the sites began to diverge.

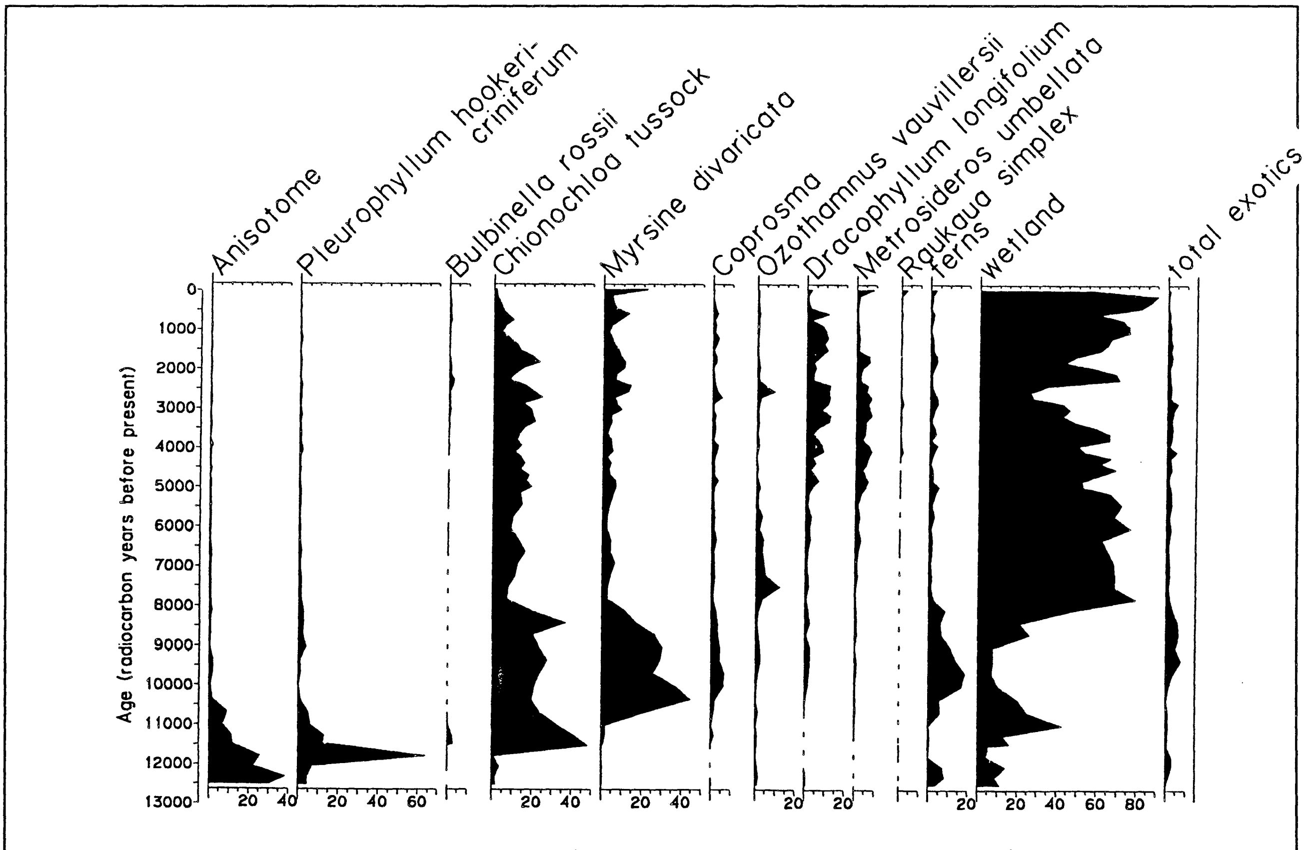

Fig. 5. Pollen diagram, bog site, Deas Head, Auckland Island

The forest site supported a tall mixed scrub–grassland with few wetland plants. At the same time, wetland became dominant at the bog site, and has remained so ever since.

Forest trees in the form of *Dracophyllum* and rata are represented in the pollen rain from the beginning, but almost certainly as stunted scrub specimens. The bog site indicates the first sustained occurrence of rata and *Dracophyllum* pollen at levels which suggest nearby forest at around 5000 years ago; the forest site is definitely dominated by forest 4000 years ago. From these, and other sites, we conclude that forest of some sort probably began to spread on the island shortly after 7000 years ago, culminating 4000 years ago. From what we can see at the Neville Moar site and from our more recent sites, forest has never been stable. It seems to have expanded and retreated and undergone precipitous collapses.

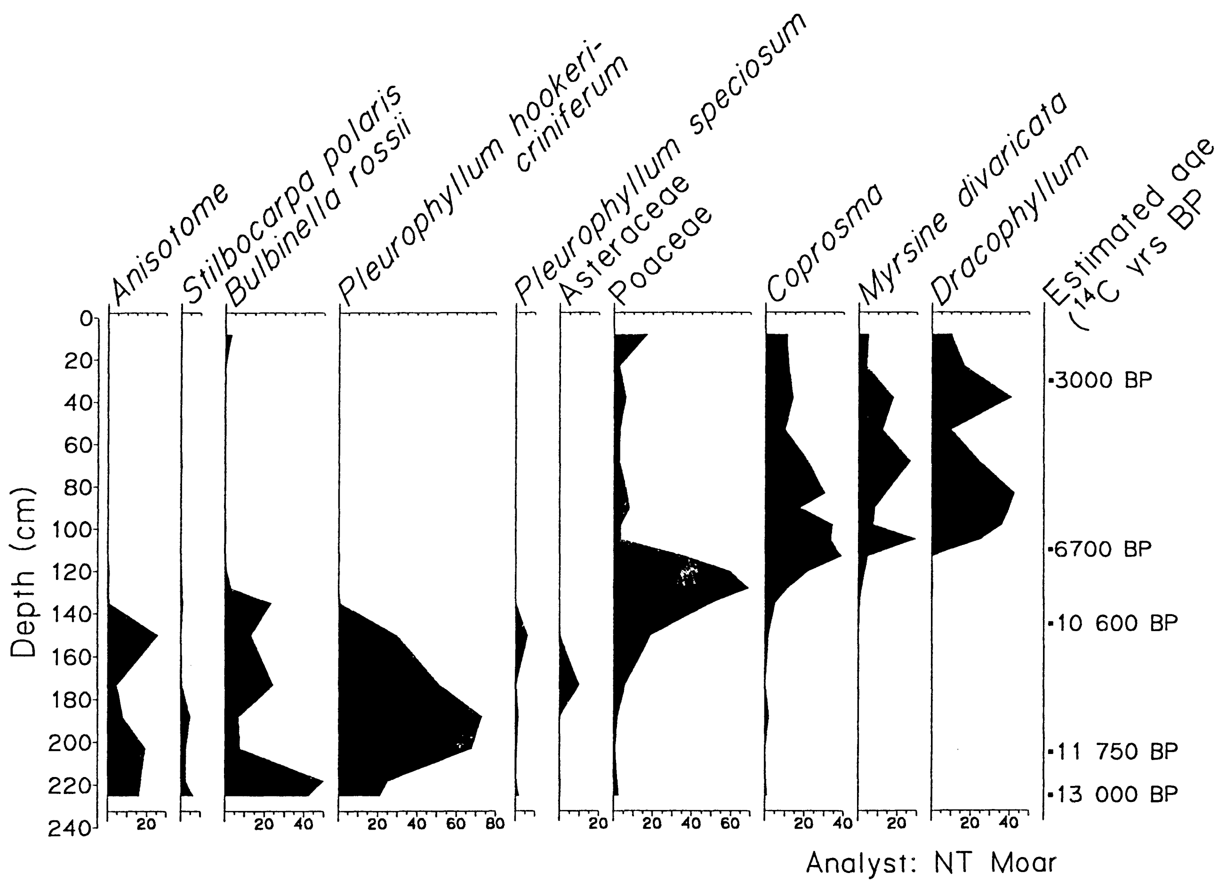

Fig. 6. Pollen diagram, Beeman Hill, Campbell Island. From McGlone et al. 1997.

Much the same conclusions have been reached from a similar study we have done on Campbell Island (Fig. 6), excepting that there the forest is entirely of *Dracophyllum*, or "draco" as the natives term it. In climatic terms we have a paradox. During what we suspect to have been the warmest period of the postglacial period, 10,000 to 7000 years ago, forest was highly restricted. Bear in mind also that forest had expanded on the New Zealand mainland between 14,000 and 9500 years ago. During a period we know to have been a cooler one, forest expanded. We can see a parallel with mainland New Zealand as well, for it was not until after 7000 years ago that beech forest began to dominate tree lines.

We can only speculate about these changes in the absence of reliable estimates of past temperatures. At the moment we think that wind flow patterns have had a great deal of influence on these vegetation changes. After the cold of the glacial period, and presumably strong southerly and westerly influence, the main wind flow turned to the north and west, and probably weakened in intensity. Warm, humid air was brought down over New Zealand and as far south as the subantarctics. Although this created moist, stable, warm conditions in the lowlands, it brought excessively cloudy conditions to the main mountain areas, and dry conditions in inland districts. Hence, tree line species were suppressed, and forest kept out of the interior. On the subantarctics, already very cloudy and humid, sea level fog and cloud virtually suppressed all forest. After 7000 years ago, increasingly southwesterly wind flow brought rain to central Otago, and cool, wetter conditions to all of coastal Southland and Otago, and hence the spread first of rimu, then later of beech species. However, the flow of warm humid air from the north became less, and the high mountains experienced brighter, clearer conditions in summer, and beech forest spread. In the subantarctics, this change was a two–edged sword. On sheltered areas, forest spread; but on the windy exposed coast, forest could not persist in the face of increased strong southwesterly winds.

It is interesting that our appeal to wind flow patterns to solve the conundrum of vegetation change in the south should have been foreshadowed by Cranwell and von Post:

"Their main point is that fact that podocarp forests, such as occupy now the lowlands of the southeastern coast regions of South Island, were largely extended in Period II outside their present area, probably all over the interior. These podocarp forests being, at present, due to the influence of rain–bearing south–easterly cyclonic sea–winds, their former extension further inwards would suggest these winds to have been strengthened. This, however, was hardly the primary cause of the phenomenon concerned. On the contrary, it indicates, in its turn, a general change in the atmospheric circulation over these parts of the South Seas. As a matter of course, the cause of this larger phenomenon must have been at the bottom as the actual cause of the post–Pleistocene phyto–geographical changes demonstrated in New Zealand."

Final words

Lucy Cranwell's career was not marked by any great effusion of publications, but her impact on palaeoecology in New Zealand was nevertheless enormous. Her early initial publications set the scene for all subsequent activity, and her contribution to the systematic description of pollen and spore types got the new discipline of pollen analysis off to the best possible start. Without her, there is no doubt that it would have taken a much longer time for palaeoecology to have begun making a contribution to ecological science in this country.

One of the great strengths of the New Zealand botanical tradition has been the room it has made for the amateur to make a real contribution to scientific advances. Lucy Cranwell recognised this in her early efforts, and that tradition has carried on. In preparing this presentation, I read over a number of articles in the Newsletter of the Auckland Botanical Society, and was struck once again by how diverse and stimulating the contributions were. In my everyday work I am conscious of how much we depend on such botanical work continuing, and how much it underpins the work of often office– and laboratory–bound professionals. So, in closing, a heartfelt thank you to those of you who keep the tradition alive, and long may it continue.

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Indigenous vascular plant species list for Karioitahi Beach field trip

Steve Benham & Bec Stanley

On the 18 March 2000 Auckland Botanical Society visited Karioitahi Beach, south-west Auckland. The fieldtrip was recorded by Leslie Haines (2000).

Acaena novae-zelandiae
Adiantum cunninghamii
Apium prostratum
Apodasmia similis
Arthropodium cirratum
Asplenium oblongifolium
Asplenium appendiculatum subsp. *maritimum*
Astelia banksii
Blechnum triangularifolium
Calystegia soldanella
Carex flagellifera
Carex testacea
Coprosma acerosa
Coprosma robusta
Cortaderia splendens
Corynocarpus laevigatus
Cotula coronopifolia
Cyperus ustulatus
Desmoschoenus spiralis
Disphyma australe
Dodonaea viscosa
Geniostoma rupestre
Gunnera dentata
Haloragis erecta
Hebe stricta
Isolepis cernua
Isolepis nodosa
Juncus caespiticius
Lachnagrostis billardierei
Lagenifera pumila
Leptinella dioica
Leptinella dispersa* subsp. *rupestris
Leucopogon fasciculatus
Leucopogon fraseri
Liliaeopsis novae-zelandiae
Lobelia anceps
Macropiper excelsum
Microsorum pustulatum subsp. *pustulatum*
Muehlenbeckia complexa
Olearia solandri
Ozothamnus leptophyllus
Phormium tenax
Pimelea prostrata
Pratia angulata
Pseudognaphalium luteoalbum
Pseudopanax lessonii
Pteridium esculentum
Pteris tremula
Samolus repens
Sarcocornia quinqueflora
Selliera radicans
Senecio lautus
Sonchus kirkii (see Cameron 2000)
Spinifex sericeus
Tetragonia trigyna
Triglochin striata
Zoysia pauciflora

Bold type indicates taxa that are listed on the Auckland Regional Threatened Plant List.

References
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Field Trip to Brick Bay Reserves, 13 May 2000

Fran Hintz

Brick Bay is a delightful sandy beach lying between the Sandspit estuary and Snells Beach, once accessible only by a low-tide scramble around the rocks. However since the sub-division of the coastal farm behind it into sections on which prestigious houses have been built, there is road access, and a picnic area has been established adjacent to the beach. In addition, two small reserves containing remnants of the original flora (possibly cut over) have been established. These are not large and depend for their integrity on the care of neighbouring property owners; however we found a rich variety of species to reward our scrambles.

As we assembled at the beginning of the road, it was good to see how the residents had tried to keep the bush cover on their sections. The *Metrosideros fulgens* was in full flower. We left the road and made our way down the valley through kauri-dominant forest, with a thick cover of seedlings. On the ground we found *Pterostylis brumalis* (in flower), *Grammitis rawlingsii*, *Lindsaea trichomanoides*, amongst other things; and Maureen pointed out the two varieties *of Asplenium gracillimum*, var. *laxum* and var. *tripinnatum*. Some of us looked again at the similarities and differences between *Mida salicifolia* (disticus) and *Nestegis lanceolata* (decussate). As well as the regenerating kauri, there were many examples of *Kunzea ericoides* reaching the end of their lives, and large specimens of *Vitex lucens.*

We were promised a hard beech (*Nothofagus truncata*), and as we turned and made our way up the stream, there they were. We came back to the road and looked with disfavour at the inappropriate plantings of native but not local species on the roadside.

After lunch down by the beach where we admired the venerable pohutukawa, we followed a track (much more civilised!) through the other reserve. Here the canopy trees were not so mature, indicating a more recent cut over, but the same species were there. We left the track to scramble again, and found another hard beech. Our journey took us to the boundary fence and the bizarre sight of an Eastern style pagoda on the private land next door, then back through the kanuka to the track.

Thank you to Maureen Young for guiding us; we both remember the days when the whole peninsula above Brick Bay was farm and bush. I suppose we have to accept the progress of civilization; anyway it is good that there are still wild places to visit.